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STRATEGIC COMPUTING AND SURVIVABILITY RESEARCH

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This document summarizes on-going technical support by The BDM Corporation for the DARPA Strategic Computing Program.

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STRATEGIC COMPUTING AND SURVIVABILITY RESEARCH

To meet the challenge of certain critical problems in defense, the Defense Advanced Research Projects Agency (DARPA) has initiated an important new program in Strategic Computing. By seizing an opportunity to leverage recent advances in artificial intelligence, computer science, and microelectronics, the Agency plans to create a new generation of "machine intelligence technology." This new technology will have unprecedented capabilities and promises to greatly increase our national security and our economic strength as it emerges during the coming decade.

Within the past few years, important advances have occurred in many separated areas of artificial intelligence, computer science, and microelectronics. Advances in "expert system" technology now enable the mechanization of the practical knowledge and the reasoning methods of human experts in many fields. Advances in machine vision, speech, and machine understanding of natural language provide easy ways for humans to interact with computers. New ways to structure the architectures of computers enable computations to be processed in parallel, leading to large improvements in machine performance. Finally, new methods of microsystem design and implementation enable the rapid transfer of new architectural concepts into state-of-the-art microelectronics.

These separate advances can be jointly exploited to mechanize the thinking and reasoning processes of human experts into the form of powerful computing structures implemented in microelectronics, thus creating machine intelligence technology of unprecedented capabilities.

DARPA's Information Processing Technology Office (IPTO) contracted The BDM Corporation (BDM), effective January 12, 1984 but including the pre-contract period from November 28, 1983, to provide program management and technical support for its Strategic Computing and Survivability program (now known as the Strategic Computing Program).

This quarterly technical report summarizes the technical support initiated and provided by The BDM Corporation during the pre-contract period and the first quarter of the contract.

SUMMARY OF TASKS AND RESULTS

A. LAN INTERFACE TO INTERNET

The purpose of this task is to support DARPA's Strategic Computing Program in the identification and refinement of requirements and conceptual design(s) for the digital interface between DARPA's IPTO and BDM's LAN office located in Rosslyn, Virginia.

BDM identified the requirements and conceptual design with a structured/phased approach. The first phase was to identify the information requirements and operational concept of both the IPTO LAN and BDM's LAN office as they relate to DARPA's needs. Next, functional requirements for the digital interface were examined. Alternate designs and implementations were considered. Analyses were conducted, including cost benefit and risk analyses.

Work conducted was documented by requirements, operational concept and conceptual design briefings. The "DARPA IPTO LAN & BDM LAN INTERFACE" briefing was given on January 10, 1984; the "BDM Strategic Computing Support Service - Concept Definition Briefing" on February 23, 1984; and the "DARPA IPTO/BDM LAN Connection Phases - Hardware and Capabilities" briefing on February 29, 1984.

Technical problems identified included:

(1) The LANs are not colocated;

(2) The ETHERNETs used in the two LANs were not compatible;

(3) Development of generic graphics for the SC database concept; and,

(4) Employment of a large screen video display and large scale plotter. This issue was set aside by direction from DARPA.

Technical results included:

(1) LAN-to-LAN interface is possible using an existing IMP and using a modified LSI 11/23 gateway;

(2) LAN-to-LAN connection can be achieved by packet radio; and,

(3) A recommended final design.

BDM will proceed to produce a detailed design based upon the preliminary design of the IPTO/BDM LAN connection, continue communication with selected vendors, and finalize design activities including: choice of software packages, production of installation drawings with hardware lists and vendor quotes, production of a schedule including subcontractors' installation cost (where appropriate), and time quotes. Particular emphasis will be placed on investigating a cable connection through the CSS facility to DARPA followed by the implementation of a Packet Radio connection. The details of the hookup and an analysis of this application's operational impact on the PRNET will be investigated. A backup contingency plan will also be developed.

B. DSB SUPPORT

BDM is assisting the Defense Science Board (DSB) Task Force on Military Applications of New-Generation Computing Technologies with the publication of their Final Report. The creation of the Task Force was requested by DARPA for the purpose of giving guidance in the conduct of the Strategic Computing Program.

During the current reporting period, BDM personnel attended the Task Force meetings in December at Rockefellar University in New York City and in February at DARPA. Draft minutes of these meetings were prepared and given to Cdr. Ohlander, the Executive Secretary to the Task Force, and to the Task Force Chairman, Dr. Lederberg, for approval.

The body of the first draft of the Final Report of the Task Force was written by BDM personnel and was printed and distributed to the members of the Task Force at the end of January. The report also contained papers sponsored by individual Task Force members. One of these papers, titled "Autonomous Vehicles," was prepared by BDM personnel and approved by its sponsor, Dr. Charles Herzfeld. Another paper, "Ballistic

Missile Defense," was prepared by Dr. Duane Adams, whom DARPA requested that BDM hire as a consultant to work with the paper's sponsor, Dr. Perry. In addition, several other papers in the draft report were substantially edited by BDM. Other contributions by BDM personnel included preparation of a narrative summary of ongoing DoD research in artificial intelligence.

The second draft of the Final Report was also edited, printed, and distributed in mid-March, in advance of the March 30 meeting of the Task Force at Rockefellar University. A third edition has also been scheduled, in accordance with the wishes of the Task Force.

C. TEST AND EVALUATION SUPPORT SERVICE STUDY

The purpose of this task is to support DARPA's Strategic Computing Program in the study and definition of requirements for the Test and Evaluation Support Service. This task began with the definition of what is necessary to provide test and evaluation environments and tools to the rest of the emerging technologies within the SC program.

BDM is working with DARPA to identify key areas within the SC program where common testing and evaluation are possible. Examples of these areas are remote machine links to test computing capacities in situ or simulations on new machine environments in support of planned applications demonstrations. BDM will specify these areas and aid in the structuring of the interrelationship between a proposed service and the applications, generic functions, and machine architecture portions of the SC program.

Deliverables for this task include interim progress briefings, as required by DARPA, and a final briefing by April 12, 1984. This briefing will summarize the preliminary results of this activity, including initial identifications of testbeds (where, for what, and how many) and their envisioned T&E requirements, as well as an initial scoping of facilities considerations, with an emphasis on potential cost bounds and communications requirements.

D. SYSTEM KIT IDENTIFICATION AND SUPPORT

The purpose of this task is to support DARPA's Strategic Computing Program in the identification and development of suitable "system kit" manufacturers to include within the program. In the search for appropriate manufacturers, emphasis will be placed on production engineering, detailed documentation, and a high level of educational support for the system kits. The end result of this task will be the identification of one or more system kit manufacturers or potential manufacturers, a draft announcement for sources sought, and a set of strawman criteria for evaluating the solicitation.

Specifically, BDM is searching the available literature for candidate manufacturers, and will work with DARPA to highlight those with the most potential. Key elements in this search will be documented and will form the basis of a strawman set of vendor evaluation criteria. A draft announcement for a sources sought solicitation will be prepared. Having completed these activities, BDM will work with DARPA to release the announcement and refine the evaluation criteria.

Deliverables on this effort include interim briefings, as required by DARPA, and submission of the draft sources sought announcement and strawman evaluation criteria.

E. IMPLEMENTATION PLANNING

The purpose of this work has been to support DARPA's Strategic Computing program in the generation and preparation of implementation plans and commitment rate estimates.

Implementation plans cover the following aspects of the Strategic Computing program:

- o Pilot's Associate;
- o Battle Management - Fleet Command Center;
- o Battle Management - Carrier Group;

- o Autonomous Land Vehicle;
- o Computer Vision;
- o Natural Language Understanding;
- o Speech Understanding;
- o New Generation Expert Systems;
- o Machine Architecture;
- o Optoelectronics Technology; and,
- o Infrastructure.

For each of these areas, several key BDM personnel work closely with DARPA program managers, meeting frequently to discuss timelines, program milestones, their proper relationships to major demonstrations, and commitment rate estimates.

These programs are then analyzed by BDM to ensure proper coordination of events and structuring of technology transfer mechanisms between the military applications and the tech base support areas. This process of interacting with DARPA program managers and analyzing the interrelationships of the programs is leading to an overall implementation plan "document" for the Strategic Computing program. BDM is providing the necessary standardization and publications support and has established a methodology for obtaining the appropriate information and placing it in a usable and easily updatable format.

Deliverables for this work have included interim progress briefings, as required by DARPA, and extensive briefing materials for DARPA program managers. These briefing materials were used in the Strategic Computing Program Reviews for Dr. Robert S. Cooper, Director of DARPA, on February 2, 15, and March 6, 1984. The Program Review briefing scheduled for April 9, 1984 is in preparation.